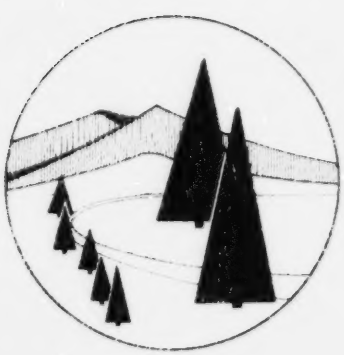

FOREST RESEARCH COUNCIL
OF BRITISH COLUMBIA

FORUM

on

INTENSIVE SILVICULTURE AND FOREST RECREATION

held on

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Vancouver, B.C.

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THE FOREST RESEARCH COUNCIL OF BRITISH COLUMBIA

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PREFACE

The OBJECTIVE of this forum was to ascertain what research or investigation is needed at the Intensive Silviculture/Forest Recreation interface, by

i) describing and identifying those areas of B.C. likely to be managed principally for;

   a) intensive timber production,
   b) extensive timber harvesting, or
   c) other values,

ii) relating recreational needs and opportunities to intensive timber production management;

and iii) identifying and ranking information gaps which impede decision-making and militate against optimal utilisation.

Meeting this objective will help the Council to fulfill its mandate, part of which is to identify, to the Minister of Forests, research needs in forestry for B.C. and to set priorities on these needs.

To this end a small group* was assembled to explore the topic and to suggest areas of needed research.

* Participants are listed in Appendix 1.

ABSTRACT

This Forum on Intensive Silviculture and Forest Recreation was convened to identify research needs and priorities at the interface between these two sets of activities.

Following three statements describing intensive silviculture and one on identification of suitable locations, six representatives of recreational users of the forest set out their concerns.

Subsequent discussion led to formulation of six recommendations. In brief these are: that a test or demonstration area be established for study of conflicts; that "profiles" of recreational user groups be developed; that benefits and costs of providing for forest recreation be assessed; that studies be continued to evaluate non-consumptive uses; that analytical methods be developed for common use by all managing agencies; and that information needs be clearly identified.

SESSION 1: What is intensive silviculture?

Chaired by W. Young, this introductory session was in two parts.

A. What is intensive silviculture?

The first segment comprised three invited papers prepared by:

D.L. Handley, from an industrial silviculturist's perspective;
D.P. Lavender, an academic forester and
C.M. Johnson, speaking as a senior government silviculturist.

Their papers appear, in full, in Appendix 2.

Resumé

Intensive silviculture may be defined as "the science and art of managing the biological and edaphic (= soil) resources of a forest area so as to ensure the maximum yield of desired goods and benefits, in perpetuity". In practice this requires a sequence of operations beginning with establishment or re-establishment of a tree crop, tending this crop to maturity and then harvesting. Establishment requires some form of site preparation--removal of debris mechanically or by fire, then partial or complete cultivation--followed by planting, nowadays with genetically-improved stock. As in gardening, this crop of trees must be weeded, spaced or thinned, perhaps pruned, fertilized and protected through its life, or rotation, until it is harvested and the cycle resumes, a period of 40-80 years.

The inherent qualities of the site--fertility, stability, and topography, the costs of raising and of harvesting the crop, and the value of the harvest all bear on the amount of money which can be invested in any area. It is fairly obvious that high quality sites close to processing facilities will be the most favored for investment in intensive silviculture. It is unfortunate but inescapable that these most favored locations are sought after for many other valid purposes also--farming, urban expansion, transport routes, even hydro-electric reservoirs and, in B.C., are of very limited extent.

B. Where could/should intensive silviculture be practised?

In this second segment F. Hegyi showed, in a talk illustrated with slides, how modern techniques of satellite imagery with computer mapping and graphics can depict in 3-dimensional figures the "lie of the land"; its characteristics of aspect, elevation, slope and soil; its present and potential uses, and management constraints or requirements. Satellite imagery also makes frequent up-dating readily feasible.

Rather than addressing directly the question "where can intensive silviculture be practised?" he showed how modern technology can help significantly in finding the answer.

SESSION 2: RESPONSES BY NON-TIMBER USERS

Professor Day chaired this second session in which representatives of six groups which use the forests for something other than wood production outlined their needs and concerns for the effects of intensive silviculture.

R.J. Beamish - anadromous fish

An imperfect data base and less-than-complete understanding of the whole picture of the population dynamics of anadromous fish species inhibit evaluation or prediction of logging impacts on fish habitat.

The aim should be to maximise annual escapement rather than simply to protect the stream environment. It may well be that, in some circumstances, logging will enhance carrying capacity or productivity for fish. Responding to questions, Dr. Beamish noted that productive capacity is quantified by assessing:

> spawning areas and quality, food availability, and temperature regimes;
>
> to maximise escapement active or interventionist management of a catchment area may be needed;
>
> data collections are being co-ordinated and data analyses are being accelerated;
>
> as with most or all other resource agencies, data collection could be more effectively correlated and integrated.

D. S. Eastman - A wildlife perspective--research needs for interactions between intensive silviculture and forest recreation.

Forest recreation includes a great variety of activities--walking through a forest stand, picnicking at a campsite, or hunting elk in a second growth forest. What these activities obviously have in common is that they occur in a forest. What these activities have in common that may not be obvious is that wild animals play a role in people's enjoyment of these recreational activities. This role may be central in the case of a hunter or wildlife photographer, or of less importance in the case of campers who feed whiskey jacks from the picnic table.

The term "wildlife" encompasses more than just game animals. It means all wildlife species, and the need to manage all species is a challenge facing wildlife and forest land managers in British Columbia, especially with the increasing interest in intensive silviculture. Since it is practically impossible to manage all populations of all these species, one route is to manage their habitat. As most of the species use or are dependent upon forests to meet their life requirements, it follows that forest management will affect most of the province's terrestrial vertebrates (as well as many aquatic species, of course). It also follows that habitat management will most likely be achieved through forest management. However, as Jack Ward Thomas wrote[1]

> "Forest management will be good wildlife management only in so far as forest managers are made aware of the habitat needs of wildlife species, have the tools to do habitat management, and have the attitude or the obligation to help achieve wildlife habitat management objectives."

It is the former two requirements that bear most directly and obviously on the focus of this forum, although attitudes will be modified by our meeting and its recommendations.

[1] Thomas, J. Ward 1979. Wildlife Habitats in Managed Forests: The Blue Mountains of Oregon and Washington. U.S.D.A. Forest Serv. Handbook 553.

Since there is a continuum of techniques from basic to intensive silviculture, there is also a continuum of impacts on wildlife habitat (Fig. 1). Impacts range from positive to negative, and from slight to severe, depending upon the area affected, the timing and duration of the activity, and the species of wildlife affected.

Based on research to date, the main impacts of intensive silviculture on wildlife and their habitat are the truncation and alteration of natural successional pathways and stages, and the simplification of forest stands, that is, the trend towards uniformity. These impacts are of particular concern because they can eliminate habitats required by some species and thus lead to their absence from an area, or reduce the habitat's suitability and thus lead to reduced numbers. A more general concern is that obvious changes often lead to unexpected changes some of which may be decidedly undesirable.

These are generic concerns, but more specifically, whether or not intensive silvicultural actions are of concern to a wildlife manager depends upon the management objectives for the species in the treatment area. As noted above, at the very least, the manager should be concerned about the impact of silvicultural activities on species diversity or richness. The degree of concern will be much greater where recreational demands are great, where key species are vulnerable, or where some other consideration acts to increase the degree of management scrutiny.

From the wildlife perspective, the major challenge for the topic area is to predict consequences of silvicultural techniques and regimes with a desired degree of reliability. Managers need to be able to predict the population consequences of habitat alterations before they occur, so appropriate changes can be considered.

Timber production activity	Potential Impact (High, Moderate, Low, +ve or -ve)															
	Species A				Species B				---				n			
	Food	Cover	Repro d	Special	Food	Cover	Repro d	Special	Food	Cover	Repro d	Special	Food	Cover	Repro d	Special
Access system																
Site Preparation																
Planting																
Weeding																
|																
|																
|																
Harvesting between stands pattern																

Fig. 1. A way of identifying impacts of silvicultural activities on wildlife habitat requirements, as a basis to defining research needs.

Editor's note: This scenario refers to clear-cutting. Uneven-aged or multi-aged stands, created by selection system management, are a major contributor in the B.C. interior to wildlife and cattle ranging habitats (Douglas-fir and Ponderosa pine).

This major challenge has two principal research areas:

1. developing organized w..ys of inter-relating impacts of forestry operations and the habitat requirement of all wildlife species and,
2. specific research topics on particular species or particular silvicultural techniques, e.g., herbicides.

Some work is already underway on both topics. The Wildlife Habitat Handbook project is addressing methods for presenting existing information in an accessible format. These methods will be most useful for dealing with the concern for species richness, but can also be applied to key or featured species. Research is also beginning on impacts of herbicides on wildlife and their habitats; some research has already been done on the impact of spacing debris on habitat use in second growth stands. Many of the habitat-related projects currently underway (IWIFR, coastal and Flathead grizzly, west-central caribou) also will be valuable in providing the information required by managers to make informed decisions on silvicultural impacts. Additionally, specific topics will be defined in the near future as the magnitude and scope of intensive silviculture strikes home.

J. Peepre

While the forest as a resource is well known, we have only scanty information on the user, and of interactions amongst user groups.

Access is a key issue - its provision, control, accessibility, maintenance and effects all need investigation.

We need i) to distinguish between research needs and operational or management monitoring;

ii) to develop user profiles;

iii) to determine the economics of forest recreational uses and to fund research proportionately.

Timber operations could be more flexible to accommodate recreational uses of the forest better.

Questions and subsequent discussion reinforced the need to describe clearly the user community. Better awareness and comprehension of the complexities of the interactions is needed not only in the general public and the user groups but also in officials charged with management.

J. Masyk

Since overlapping pressures for use are greatest in areas close to urban centres, there is need for intensive recreation management as well as for silviculture so that resources managers can capitalise on mutually beneficial operations.

The purposes of parks are to some extent contradictory - protection v. access v. control of fire. Definitions of recreation and silviculture vary as widely as do those of wilderness, and a better understanding of each is required before their co-existence can be managed.

There is an urgent need for an overall Strategic Plan, for sharing of technology and knowledge, and for consideration of how timber production and parks can co-exist.

V. Collins

From the perspective of land use planning, there is need for definition of overall objectives and, within these, need to reconcile conservation or preservation with recreational uses to alleviate general uncertainty over long-term aims.

The provincial parks system has five basic goals:

i) to protect and preserve representative natural areas in B.C.
ii) to provide roadside stopping places;
iii) to provide dispersed outdoor recreational opportunities;
iv) to protect endangered species - plant or animal;
v) to foster relevant research.

An integrated management policy or plan is needed but no obvious lead agency is available. This area is outwith the Forest Research Council's mandate.

H. Marshall

While intensive silviculture can mean different things to different people, recreational uses of the forest too need definition. In planning for intensive silviculture, foresters must be holistic and must not ignore the human element. For example, the greater access required for intensive silviculture should be designed with recreational use possibilities in mind, although appropriate social and demographic data are lacking. Similarly, the choice of silvicultural system affects recreational opportunities.

The areas of greatest concern to recreationists are:

i) the land/water interface;
ii) access to riparian and foreshore areas;
iii) location of user facilities
iv) landscapes

Participants suggested the addition of:

v) alpine areas/forest interface.

Benefit/cost studies of constraining timber production to meet concerns for these key areas are needed. Public wants, needs and perspectives are ill-defined.

SESSION 3: DISCUSSIONS AND RECOMMENDATIONS

This general discussion, chaired by R.H. Ahrens, brought out several interesting points.

There is need for research to describe the "recreator" - what are his/her needs in terms of both quality and quantity; and how much of the perception of conflict is based on misunderstanding.

In this context, a need was clearly recognised for access management--who can go where, at what times and under what circumstances. This is an operational and management problem which requires thoughtful inputs from everyone involved. There was no support for the concept of denying or restricting access to areas managed intensively, though temporary closure if clearly justified and explained could be acceptable. These concerns show the wish for public participation at an early stage of planning for intensive silviculture to ensure that non-timber uses are recognised. However, they beg the question of reconciling timber and non-timber requirements should these, in fact, conflict.

A topic of considerable concern was the land/water interface, and resources management in this area. Jurisdictional and administrative responsibilities in this area need clarification.

Concern for landscape values was expressed, a concern which is being met at least in part by the Ministry of Forests' initiatives in regulating the shape, size and location of cut blocks in relation to visual effects.

A rather contentious issue is the question of buffer strips along roads and around parks, ecological reserves and other areas excluded from timber harvesting. Who should manage these fringing zones and to what level remains unresolved.

There was unanimous support for establishing a co-operative demonstration area where problems at the operational interface between intensive silviculture and forest recreation could be identified, studied and evaluated. Of the several candidate areas suggested--Chilliwack/Vedder Mountain, Sayward Forest, Seymour watershed Forest, Skagit Valley and Tsitika--the Skagit Valley was most favoured. (Ed. note. Since the meeting, a silviculture demonstration area at Chilliwack has been announced.)

From these discussions and in an endeavour to generate information relevant to the concerns of the resource managers, six recommendations were formulated. No consensus could be reached on the relative importance of the six although there was a feeling that, as presented, they form a logical sequence.

RECOMMENDATION 1. THAT A FOREST AREA BE SET ASIDE FOR INVESTIGATIONS OF THE RELATIONSHIPS, COMPATIBILITY AND CONFLICTS BETWEEN INTENSIVE SILVICULTURE AND ASSOCIATED FOREST RECREATION OPPORTUNITIES.

This area should be close to a population centre and the Skagit Valley Recreation Area is proposed as a suitable locale. An integrated management team will oversee development and implementation of a suitable Working Plan, which will include a significant public information and response component.

RECOMMENDATION 2. THAT RESEARCH BE INSTITUTED TO IDENTIFY THE SOCIO-DEMOGRAPHICS OF RECREATIONAL USERS OF THE FOREST--THAT IS, WHO ARE THEY, WHERE DO THEY COME FROM, HOW MANY ARE THERE IN EACH SEPARATE USER GROUP, AND WHAT DO THEY WANT IN THE WAY OF OPPORTUNITIES AND FACILITIES? ARE THERE CONFLICTS AMONGST USER GROUPS?

It must be noted that there are several unquantifiable elements here which can be assessed only subjectively.

RECOMMENDATION 3. THAT ANALYSES BE UNDERTAKEN INTO THE COSTS AND BENEFITS OF PROVIDING FOREST RECREATIONAL OPPORTUNITIES.

This recommendation recognizes that, as yet, there is no clear understanding of the economics or requirements of forest recreation. For example, how does forest recreation relate to tourism as a whole, and what is its economic effect on provincial and regional economies. Also it will require rigorous analyses of intensive silvicultural operations and the constraints on these operations due to the need to meet recreational demands.

Two subsequent recommendations parallel one another closely.

RECOMMENDATION 4. THAT RESEARCH BE CONDUCTED TO ENABLE RESOURCE MANAGERS TO QUANTIFY NON-TIMBER RESOURCE VALUES AND NEEDS: I.E. WILDLIFE, WHETHER FOR HUNTING OR VIEWING: SPORT AND COMMERCIAL FISHING: SUCH NON-CONSUMPTIVE USES AS CAMPING, HIKING AND AESTHETIC ENJOYMENT.

RECOMMENDATION 5. THAT RESEARCH BE CONDUCTED TO DEVELOP GENERALLY ACCEPTABLE METHODS FOR ANALYSING RESOURCE MANAGEMENT OPTIONS WHICH LEAD TO LAND ALLOCATION DECISIONS AND CHOICES AMONGST OPERATIONAL ALTERNATIVES.

One technical recommendation arose from this previous recommendation.

RECOMMENDATION 6. THAT RESEARCH BE CONDUCTED TO IDENTIFY THE INFORMATION NEEDS OF RESOURCE MANAGEMENT PRACTITIONERS AND OF THE GENERAL PUBLIC AT THE INTERFACE BETWEEN INTENSIVE SILVICULTURE AND FOREST RECREATION MANAGEMENT.

For the practitioners, these studies should elucidate:

i) optimal sampling design and sampling techniques;
ii) a priority ranking of information needs; and
iii) identification of enhanced management options which can be examined with the new information.

APPENDIX 1

LIST OF PARTICIPANTS

*R.H. Ahrens, formerly Deputy Minister, Ministry of Lands, Parks & Housing

Dr. R.J. Beamish, Director, Fisheries Research Branch, Pacific Biological Station, Nanaimo

Dr. V.C. Brink, Professor-Emeritus, University of British Columbia

Dr. A.D. Chambers, Faculty of Forestry, University of British Columbia

M.V. Collins, Assistant Deputy Minister, Parks & Outdoor Recreation Div., Ministry of Lands, Parks & Housing

*Dr. J.C. Day, Professor, Natural Resources Management, Simon Fraser University, Burnaby

Dr. D.S. Eastman, Manager, Research & Development Section, Wildlife Branch, Ministry of Environment

D.L. Handley, Manager, Designed Forest Section, Woodlands Services, MacMillan Bloedel Ltd., Nanaimo, B.C.

W.J.B. Devitt, Chief Forester, CIP Forest Products Inc., for Council of Forest Industries

K. Fairhurst, Landscape Coordinator, Vancouver Region, Ministry of Forests, for Dr. P.J. Dooling, Faculty of Forestry, U.B.C.

F. Hegyi, Director, Planning & Inventory Branch, Ministry of Forests

C.M. Johnson, Director, Silviculture Branch, Ministry of Forests

Dr. D.P. Lavender, Head, Forest Sciences Dept., Faculty of Forestry, U.B.C.

H.N. Marshall, Director, Recreation Management Branch, Ministry of Forests

J. Masyk, Superintendent, Pacific Rim National Park, Environment Canada, Ucluelet

J. Peepre, Chairman, Outdoor Recreation Council of B.C., Vancouver

D. White, Senior Research Officer, Management Services Division, Ministry of Tourism

*W. Young, President, British Columbia Forestry Association, Vancouver

Forest Research Council Members

Dr. P.C. Trussell, Chairman
N. Purssell
Dr. R.M. Strang, Executive Director
M.L. Wallis, Secretary

* Session Chairman

APPENDIX 2

Invited Papers - " What is Intensive Silviculture?"

AN INDUSTRIAL PERSPECTIVE

D.L. Handley

Introduction

Intensive silviculture is a component of forest management. Forest management is the ongoing and continuous management of the forest and the associated forest land base for the production of social goods and values (primarily raw logs in B.C.) according to an approved management and working plan (M&WP). Each M&WP has a five-year life span, thus every five years there is an increasingly complex and protracted rewrite and review process which currently takes about 18 months.

Strictly from the forest products perspective, the most critical aspect of the process is the calculation of the level of cut for the next five years; increasingly, the desired level of harvest is the driving mechanism for the silviculture level to be practiced. For many and varied reasons, primarily land losses and the "fall-down" effect, management of the new forest is becoming increasingly intensive as foresters respond to the demand that the level of cut be maintained or increased. Under the system of management and control on the tree-farm licences we must be able to show that the level of cut can be maintained over a one to two hundred-year period (two rotations) at or above the long-run sustained yield (LRSY) assuming only basic silviculture is carried out.

To complete my introduction, I feel I should at least attempt to explain "fall-down" and LRSY. The trees in a forest can be likened to a human population. In extreme infancy growth - though very fast in absolute terms - is slow in terms of what we can see. Next comes the adolescent stage when growth is visibly fast (though slowing in absolute terms) until at maturity growth tapers off. Unlike humans, trees continue to grow in height as well as girth after maturity for as long as they live, but growth rate continues to slow. Finally, to complete this analogy, the rate of mortality in trees (in absolute volume) tends to increase with age. Under forest management, as practiced in Europe or the plantations in New Zealand or Australia, trees are harvested as the growth rate peaks (i.e., 15 to 16 years in human terms). In B.C. most of our forests are well beyond the 50 to 150 years at which growth peaks, thus when we cut trees that are 100 or more years older than when growth peaks they have a greater volume per hectare of land than would the newly-mature trees; this difference in volume between the old-growth forest and a newly mature forest contributes to the fall-down effect.

The LRSY of a forest is the yield that can be sustained in perpetuity assuming only basic silviculture is practised.

- Each stand of trees is harvested at the culmination of volume growth.
- Each logged area is reforested within one to three years of logging.
- Each newly reforested area is protected from weed encroachment until it is safe, i.e., no weed will be able to suppress or kill the desired crop trees.

Intensive Silviculture

Silviculture is an investment in the future at its simplest, trees regenerate naturally or are planted and young forests protected and managed to provide resources for future generations. From my perspective, the primary resource wil continue to be raw wood fibre but tempered by the fact that wood production, though primary, will not necessarily, if ever, be maximized; rather the wood production levels will probably range from 70 to 90 percent of maximum attainable by prevailaing standards and knowledge of forest productivity potential.

The common understanding amongst professional foresters of what intensive silviculture is is the definition provided by the Ministry of Forests. That is, that intensive silviculture comprises those treatments designed to improve volume or value yield in established young forests, that is when the trees are 3 to 5 m tall or taller and no longer subject to competition from plants other than their own kind.

In MacMillan Bloedel and possibly other companies, we are beginning to develop a somewhat different perspective of forest management which will have an over-riding impact on conventional silvicultural practice and rewrite the definitions of basic and intensive silviculture. It has become crystal clear over the last five years with limited funds - both public and private - available, that we must spend these funds as wisely as possible. As a result I am now going to redefine intensive silviculture, perhaps I should rename it economic silviculture, as the careful allocation of available money with the objective of maximizing the net present value of the future crop.

In theory, I see this as meaning that the level of silviculture practiced (amount of dollars spent will usually measure this) will be a function of:

- The productive capacity of the land, or how many cubic metres of wood can be grown.

- The costs of establishing, tending and protecting the unit.

- The relative harvest and transport costs.

- The expected value in dollars of the various species, volume and product quality combinations that might be produced for each ecosystem unit.

In practice, this will result in a variable management intensity. The most intensive silviculture will be practiced on those lands which yield the best return on investment. This certainly means the most productive sites, most cheaply managed and harvested and closest to the converting plant. The least intensive silviculture, conversely, will be practiced on the lowest quality site--lands with the highest management, logging and transplant costs, i.e., on shallow, rocky soils on steep, rough slopes with both long truck and water hauls.

Finally, under this definition, I can tell you what intensive silviculture will involve at various stages in the life of a stand of trees.

- At the most intensive, site preparation where necessary for a high standard of reforestation could involve:
  - a controlled slashburn; or
  - slash scattering;
  - followed by deep ploughing, fertilization and the sowing of lupins or clover or a similar nitrogen-fixing plant.

- Weeding will probably by essential and will comprise one or more manual, mechanical or chemical weedings or combinations until the crop is safe from significant weed competition.

- Starting when the trees are 3 to 5 m tall the best trees will be freed to grow by the removal of their competitors. The number left to grow will be prescribed, based on the height they must achieve before the next treatment.

- Once trees reach a merchantable and profitable size, probably in excess of 15 cm in diameter at 18 m in height, they will be thinned to favour the best trees and produce a profitable harvest of small logs. Thinning may take place only once to as many as ten times at the most intensive level of management; alternatively I could say for every increase in height of 3 m.

- On selected sites fertilizers will be applied, probably from the air. The frequency of application is not known for sure; on some sites it could be as frequently as annually, on others as infrequently as ten and perhaps later in life of the stand even as much as every 15 years.

- On yet other selected sites, the trees could be pruned to a height of 6 to 10 m to produce highly valuable, knot-free timber - generally combined with an even and controlled rate of growth by careful and frequent thinning.

- On occasion it may be necessary to apply an insecticide or a fungicide to protect the crop from insect or disease losses. The frequency and amount of pesticide used cannot be forecast. Obviously, the material used and the method of application will be in keeping with Federal and Provincial law and the requirements of the Ministry of Environment, Health and Department of Fisheries and Oceans.

On the most intensively managed sites harvesting will be most frequent - perhaps as often as every 40 years, probably no longer than every 75 years.

To sum up, intensive silviculture - consisting of site preparation, planting, weeding, spacing, fertilization, pruning, thinning and possibly treatment of insects and/or disease will tend to be practiced:

- Close to towns and villages (mill sites or dump sites for tow to mills);
- On highly productive, machine-accessible lands.

Some form of treatment will take place every five to 15 years and will involve use of chemical fertilizers and probably some pesticides to a probable maximum of three times in the 40 to 75 year life of the forest.

As land productivity drops, as distance from tidewater increases, as roughness or steepness of land increases intensity of silvicultural treatment will decrease in keeping with the expected net present value of the crop at harvest.

WHAT "INTENSIVE SILVICULTURE" MEANS TO ME

Denis P. Lavender

Sometime ago when I was invited to participate on this panel, I accepted, without much thought, primarily on the basis that, as a new comer to the province I had an obligation to participate rather than allow colleagues to carry the load. And, of course, the prospect of a reciprocal favor someday was not unattractive. As weeks and months passed, however, I became more and more concerned that I could say anything meaningful on the assigned subject let alone add to the remarks of my co-panelists.

The question posed this panel is "What does intensive silviculture mean to me?" I was selected to answer on the basis of being an academic. I must hasten to note, however, that, while I have spent much of my career on campuses, I consider myself a forester and that my knowledge of silviculture is largely confined to that part commonly termed "Forest Regeneration". With these qualifications, then, my answer is: "intensive silviculture is management of the biological and soil resource to assure the maximum long-term yield of the designated goods and services from a given area".

Having answered the question posed, I should now sit down in favor of a prolonged coffee break, as I remain sceptical I can add to the remarks of the preceding gentlemen. However, to satisfy those few among you who may feel deprived if a speaker does not fill a scheduled half hour with "thirty minutes worth of distance run", I'll discuss thoughts at least germane to if not precisely the assigned subject.

Before I do so, however, I should mention that my definition is not universally approved by my academic colleagues. In fact I tried it on one the other day and he reprimanded me saying that "intensive silviculture" should be judged on the basis of inputs rather than results. I'm inclined to believe that this is self-serving - anyone can work apparently hard for a prolonged time without, however, producing anything useful.

I should also mention that such a definition, of course, mandates differing levels of land management for each of the diverse products a forest may produce. For areas designated as wilderness or watersheds, intensive silviculture may, in fact, mean a minimum of practices which impact the environment and maximum measures to preserve nature's status quo.

In contrast, intensive silviculture on industrial lands should include not only carefully planned harvest operations which will have the minimum possible impact on the soil resource, but measures to secure prompt, vigorous regeneration and to promote maximum yields of each developing crop.

Intensive silviculture may be most complex, however, when applied to areas designated for multiple-use. Here the often conflicting requirements for products such as wildlife, recreation, and timber must be carefully balanced, both spatially and temporally, to achieve the maximum yield of the desired products.

One of my favorite poets, Rudyard Kipling, once wrote:

> "I keep six honest serving men
> (they taught me all I knew);
> Their names are What and Why and When
> and How and Where and Who"

I've used one of them (What) already; for the remainder of this talk I'd like to use most of the rest, not necessarily in the above order.

Where in western North America is "intensive silviculture", as defined above, practised? I would judge that it is practised almost universally in areas designated as "wilderness"; frequently in private industrial holdings; and least often in private non-industrial lands (one might make a case that the owners regard their lands as primarily a recreational resource, but surveys have shown that the majority of small woodlot owners have not developed careful plans to guide production of expected products from their holdings) and on lands managed by public agencies.

Why is the level of intensive silviculture on public lands designated for timber production generally low compared with than on lands termed "wilderness" and lands managed by industrial firms? Primarily, I think, because, unlike wilderness which has strong support from urban dwellers, including many people who never have a "wilderness experience", the "intensive silviculture" necessary for sustained production of industrial products has no real clientele in urban western North America. Unlike Scandinavia, where the societies have a long history of productive utilization of their timber resource, and where workers involved in forest land management are accorded high social prestige, many immigrants to western North America came from areas where the forest resource is unimportant. These people, then, have little real appreciation of the significance of "intensive silviculture" to the regional economy nor of the complexity of proper resource management.

How does the lack of public support impact the level of "intensive silviculture" practised on public industrial forest lands? Primarily in two ways: lack of adequate financial inputs, and ill-advised restrictive regulation.

One of my colleagues, who is responsible for ecology instruction, conceptualizes his discipline in terms of energy flow between associations of organic molecules which require energy to function and reproduce. Such a definition of life may not find favor with theologans, but it does simplify complex processes, and it does demonstrate that, while material attributes such as phosphorus, nitrogen, or potassium may be recycled indefinitely, energy can not, but degrades to heat and is lost through radiation. And, finally, this treatment of ecology underlines the importance of "intensive silviculture". The earth, like every other body in the universe, is subject to the second law of thermodynamics, modified only by the radiation received from the sun. As a species, then, man has only two choices (or combinations of the two): maximize the utilization of solar radiation or rely on the energy of the atom. A coniferous ecosystem in British Columbia ranks near the

top in the world in its ability to harvest solar radiation. In fact, for every unit of energy expanded in harvesting forest bio-mass, man is rewarded with twenty units. This yield compares very favorably with that possible in efficient agriculture (less than three). "Intensive silviculture", which will assure greater production and reduce losses to disease and insects, then is one major way in which man can satisfy his continuing needs for energy.

The second major way in which society limits the practice of "intensive silviculture" is through the restriction of techniques which favor rapid, successful regeneration, such as the application of herbicides. In New Zealand, which has about the same population as British Columbia but less than one third of the area, forest lands are set aside for wilderness and recreation and other lands, for industrial forestry. On the latter, use of all techniques necessary to "intensive silviculture" is permitted - dissenters are simply told to go elsewhere. Its possible we should consider the same approach in North America.

In conclusion, I'm left with two serving men, Who and When. In so far as "intensive silviculture" is concerned, the "Who" is all of society in British Columbia which should support the use of "intensive silviculture" on public lands, and the "When" is now - we have no time to lose.

INTENSIVE SILVICULTURE AND FOREST RECREATION USES

C.M. Johnson

This morning I have been requested to address intensive silviculture and how this relates to forest recreation. When giving consideration to this topic, I wish to address intensive silviculture in the broadest context, but I shall also define intensive silviculture, as this term has large implications within the Ministry of Forests' Five-Year Forest and Range Program.

The human component of the forest ecosystem has often been overlooked by forest managers. Discussion of silviculture and natural resource management is futile if we fail to understand that people affect and are affected by the forests.

When population density was slight in B.C., impact on the forest resource base was relatively insignificant. As our population density has increased and our society becomes more complex, demand for forest goods and services is starting to exceed supply. When supplies diminish, silviculture and wise land management techniques gain emphasis.

Gifford Pinchot, the patriarch of forestry in the U.S and the first chief forester of the Forest Service, said in his book Breaking New Ground"

> "To the use of the natural resources, renewable or non-renewable, each generation has the first right. Nevertheless, no generation can be allowed needlessly to damage or reduce the future general wealth and welfare by the way it uses or misuses any natural resource."

Pinchot believed that, in a well-managed forest, resources should be used widely in a combination that best meets the needs of the people over the long term. Through careful stewardship and management we can attain a remarkable mix of goods and services without damaging future forest productivity. In recent times, however, the consumptive pressure on forest resources has spurred the development of silviculture.

Silviculture can be defined as "The science and art of growing forest crops". To this could be added to meet the land management ethics and objectives of the landowners and society. This addition helps us to focus on the need to understand that people as well as trees, wildlife, and fish, are an integral part of the forest ecosystem.

The concept of multiple-use of forest resources has developed as land managers realized that each area can provide a different mix of goods and services, a mix that may change over time as new needs arise. A key to integrated forest use is understanding the harmony that exists among the forest ecosystem units, including the human component.

We have a great deal to learn in the silviculture field as we move from a forestry base of exploitation to one which practices stewardship of the forests. One major way to learn about new silviculture initiatives is through research, with agencies and countries sharing scientific information with others. Many countries and Canada are turning to reforestation and intensive silviculture to replenish forest resources. Research in the silviculture area must be developed, applied and implemented in forestry operations.

The intensive silviculture component of the silviculture program includes treatments and activities to restock backlog forest land, and to improve the value and growth of immature forests. Treatments include backlog planting, site rehabilitation, spacing, fertilization and conifer release.

Intensive Silviculture activities are being expanded significantly as a result of the Canada-B.C. Forest Resource Development Agreement. Goals for intensive silviculture, including the agreement, are:

Intensive Silviculture Goals

	1985-86	1986-87	1987-88	1988-89	1989-90
			(Hectares)		
Survey	100,000	250,000	250,000	250,000	250,000
Backlog Planting	16,500	20,000	37,800	37,800	37,800
Site Rehabilitation	20,000	37,800	37,800	37,800	37,800
Brushing & Weeding	0	2,000	7,000	8,000	8,000
Spacing*	0	5,000	16,000	20,000	20,000
Fertilization	0	9,000	22,000	24,000	24,000
Conifer Release	0	1,000	2,000	3,500	3,500

With intensive silviculture activities there is the potential for environmental impacts occurring that will affect the fisheries and wildlife resources. With the rehabilitation of backlog sites, adverse effects could result in destruction of brush species for wildlife browse if consideration is not given to wildlife requirements. Likewise, increased mechanical site preparation for backlog reforestation and increased herbicide application for weeding of plantations hold the potential for adversely affecting the fisheries resource. Juvenile spacing operations, particularly in older plantation areas, have the ability to seriously affect the mobility of certain wildlife species. Many of these operations will have advantageous effects in a number of cases, but these generally appear to be forgotten or certainly not studied; particularly for wilderness species many of the backlog reforestation activities will result in providing new browse in areas that currently have reached a level of ecological succession that does not allow wildlife utilization.

With the expansion of intensive silviculture activities under the Canada-B.C. Forest Resource Development Agreement, we are ensuring that the various Forest Districts and Regions make provision for an annual review of the proposed intensive forestry programs by Fisheries and Wildlife Branches and Fisheries and Oceans staff in order that fisheries and wildlife concerns are given consideration as is done with the referral process for timber cutting permits.

* excludes make-work projects

As the herbicide issue is very important as a public issue in intensive forestry, I must state that the Forest Service has been a strong proponent of judicious use of this forestry tool and to use herbicides only where they are required as a cost-effective forestry tool. Our policies and procedures strongly adhere to following the course of good preharvest silviculture prescriptions, good site preparation and the use of high quality seedlings on our planting sites. However, if proper funding for these activities is not provided, we shall either forfeit high cost investments or we must look to an increased herbicide program to ensure that plantations are brought to a free growing state.

In the broadest context I would like to outline by Forest Region the problems, responses and future needs for integrated management for timber and wildlife. I have organized these in point form by Region:

Vancouver Region

Problem	Response - Ongoing
1. Old growth - deer winter range allocation issue	IWIFR deer project. Creating winter ranges in managed Douglas-fir stands.
2. Impact of backlog spacing debris on deer and elk access to habitat	IWIFR deer and elk project.
3. Old growth - elk range allocation issue	IWIFR elk project. Winter habitat requirements in managed stands.
4. Old growth - grizzly bear timber allocation issue	MOE-MOF cooperative grizzly research. Bear habitat relationships and interactions with harvesting and silviculture.
5. Deer and elk browsing damage on Douglas-fir regeneration	Quantification of damage--surveys.
6. Deer browsing damage to Red cedar on Q.C.I.	Quantification of damage--surveys.

Future Needs

1. Prediction and control of browsing damage in plantations and natural regeneration.

2. Assessment of herbicide effects on grizzly bear, deer and elk forage resources.

Kamloops Region

Problem	Response - Ongoing
1. Old growth - Caribou allocation issue	U.B.C. Masters Thesis, high priority need.
2. Dry belt silvicultural systems and mule deer habitat needs	Extrapolation from Williams Lake. High priority need.
3. Management system to consider multiple wildlife species and forest management	MOF-MOE Wildlife Habitat Handbook project. Diversity management system.

Future Needs

Caribou research to determine habitat interactions with predators and food supply, harvest and silvicultural systems.

Nelson Region

Problem	Response - Ongoing
Selkirk Caribou habitat requirements and relationships to timber harvest	International research project.

Future Needs

1. Caribou - logging research - Revelstoke, Selkirk.
2. Elk, cattle, grassland, timber regeneration research.

Williams Lake Region

Problem	Response - Ongoing
1. Old growth Douglas-fir - Mule deer timber allocation issue	Experimental selective logging for timber - Mule Deer Management Handbook
2. Old growth - Caribou timber allocation issue	Quesnel Lake Caribou - logging-predator research. Chilcotin-Tweedsmuir Caribou-logging research.
3. Squirrel damage to young pine stands	Research assessment of damage and squirrel populations.
4. Hare damage to young stands	Research assessment of damage and hare populations.

Future Needs

1. Assessment of moose - timber harvest - silviculture interactions and management needs.

2. Complete research - management investigation of Caribou - predator - habitat relationships and management principles.

Prince Rupert Region

Problem	Response - Ongoing
1. Porcupine damage to young Hemlock stands in coastal inlets	Fisher introduction for biological control of porcupines.

Future Needs

1. Investigation of moose winter - silviculture relationships (herbicide-forage).

2. Assessment of extent and severity of porcupine damage and potential interaction with stand spacing and thinning.

Prince George Region

Problem	Response - Ongoing
1. Investigation of moose - timber harvest - silviculture interactions and management needs.	
2. Assessment of cattle - moose - regeneration problems in north-east.	
3. Research on caribou - timber - predator interactions in the south-east.	
4. Assessment of moose browsing damage, herbicide application and forest regeneration.	

At the present time we are spending annually $450,000 on the above wildlife problems. In the fisheries field, the main intensive forestry studies have been on herbicides and fish interactions, and the Ministry of Forests has also completed an in-depth problem analysis of the research needs in this area. Unfortunately, we have had some considerable problems with launching some of our research projects in this area, and we are at present determining what projects will carry forward in 1986. Input for research proposals are being solicited for FRDA on backlog reforestation-rehabilitation problems. A problem analysis on herbicide-wildlife interactions and research needs will likely be funded by the FRDA program next year.

In the broader context fire and pests must be part of the intensive silviculture picture as part of the responsibility of forest managers is to protect the forest from its traditional enemies of fire, insects and disease.

Fire is used to accomplish numerous resource management objectives, including reduction of hazardous fuels, improvement of forage for livestock and wildlife, and improvement of timber stands. By controlling unwanted fire and using prescribed fires effectively, this component of the forest ecosystem can be integrated into our forest management.

As our silviculture operations become more intensive, pests such as insects and diseases are taking on a greater stature and becoming more important. We must search out natural checks and balances to pests that can be integrated into our forest management. Because forests are dynamic systems, new enemies to productivity can emerge. Atmospheric deposition is a potential enemy to forest productivity that is gaining attention.

In summary, I have attempted to portray a picture of intensive silviculture in the broadest context and have also defined more narrowly intensive silviculture within the confines of the Five-Year Forest and Range Program in B.C. In B.C. we are moving from an era of extensive forest exploitation to an era of more intensive silviculture and reforestation. With the declining ratio of forest land to population, and demands for other forest land uses, the silviculturist must continue to find ways to understand and integrate the human component into the forest ecosystem so that the managed forest can better satisfy human needs.